

## 1 CLAIMS

2 Claim 1) A method for treatment of wood having an exterior layer and interior layer and  
3 a surface comprising the steps of:

4 1) polymerizing wood cellulose by replacing at least one of the hydroxyl groups on the  
5 wood cellulose with at least one molecule containing an atom from the group consisting of:  
6 Trivalent atoms, Tetravalent atoms or pentavalent atoms.

7 Claim 2) The method of Claim 1 wherein the step of polymerization further comprises  
8 exposing the wood surface to a solution comprised of an organic solvent and at least one  
9 compound having the formula:

10  $R-Xa-Xb_3$  wherein R is a carbon compound;

11 Xa is a trivalent, tetravalent or pentavalent atom; and

12 Xb is a reactive seven valence halogen, a hydroxy group, an alkoxy group, a phenoxy  
13 group, a benzyloxy group or an aryloxy group in which the aromatic ring is replaced with a  
14 polycyclic aromatic ring.

15 Claim 3) The method of Claim 1 wherein the step of polymerizing comprises the steps of:

16 a) exposing the surface of the wood to a solution comprised of an organic solvent and at  
17 least one compound having the formula:

18  $R_3-Xa-Xb$

19 wherein R is a carbon compound;

20 Xa is a trivalent, tetravalent or penta valent atom; and

21 Xb is a reactive seven valence halogen or a hydroxy group, an alkoxy group, a phenoxy group,  
22 a benzyloxy group or an aryloxy group.

1 Claim 4) The method of Claim 1 wherein the step of polymerizing comprises a method  
2 comprising the steps of:

3 a) exposing the surface of the wood to a solution comprised of an organic solvent and at  
4 least one compound having the formula:

5  $[R]_2 Si (X)_2$ ; where R is an alkyl group ranging in carbon chain length of 1-20 units as a  
6 straight chain or as a branched chain, a phenyl group or a benzyl group and X is a halogen, a  
7 hydroxy group, an alkoxy, aryloxy or benzyloxy group.

8 Claim 5) The method of Claim 1 wherein the step of polymerizing comprises a method  
9 comprising the steps of:

10 a) exposing the surface of the wood to a solution comprised of an organic solvent and at  
11 least one compound having the formula:  $[R]_3 Si-X$ , where R is an alkyl group, a phenyl group or  
12 a benzyl group and X is a halogen, an alkoxy, aryloxy or benzyloxy group.

13 Claim 6) The method of Claim 1 wherein the step of polymerizing comprises the steps  
14 of:

15 i) exposing the surface of the wood to a solution comprised of an organic solvent and at  
16 least one metal compound from the group consisting of:

17  $Ti [R]_4$ ,

18 where R is from the group consisting of a halogen, a hydroxy group, an alkoxy group, a  
19 phenoxy group or a benzyloxy group.

20 Claim 7) The method of Claim 1 wherein the step of polymerizing comprises the steps of:

21 i) exposing the surface of the wood to a solution comprised of an organic solvent and at  
22 least one compound having the formula:  $R-Si-(X)_3$  wherein X is a halogen, a hydroxy group, an

1 alkoxy group with the number of carbon ranging from 1 to 20 in a straight chain or a branched  
2 chain configuration, a phenoxy group, a benzyloxy group or an aryloxy group in which the  
3 aromatic ring is replaced with a polycyclic aromatic ring.

4 Claim 8) The method of Claim 1 wherein the step of polymerizing comprises the steps of:

5 a) exposing the surface of the wood to a solution comprised of an organic solvents and at  
6 least one metal oxide having the formula oxide ( $X_2O_3$ ) wherein X is a metals having a 3, 4 or 5  
7 valence outer shell.

8 Claim 9) The method of Claim 1 wherein the step of polymerizing comprises the steps of:

9 a) exposing the surface of the wood to a solution comprised of an organic solvent and;  
10 at least one metal acid wherein the at least one metal has a 3, 4 or 5 valence outer shell.

11 Claim 10) The method of Claim 1 wherein the step of polymerizing comprises the steps  
12 of exposing the surface of the wood to at least one reactive borate having the general formula  
13  $B(X)_3$ , where X is selected from a group consisting of a hydroxy group, methoxy, ethoxy,  
14 propoxy, butoxy or a higher alkoxy group with a straight or branched carbon chain consisting of  
15 3-20 carbon atoms; a halogen, a phenoxy or benzyloxy group.

16 Claim 11) The method of Claim 1 wherein the step of polymerizing comprises the steps  
17 of:

18 I) exposing the surface of the wood to a solution comprised of an organic solvents and at  
19 least one silicon compound from the group consisting of:

20 a) Chlorotrimethylsilane

21 b) phenyltrimethoxysilane

22 c) Triphenylsilylchloride

- 1 d) Propyltrichlorosilane  
2 e) Propyltriethoxysilane  
3 f) Hexamethyldisilazane  
4 g) Triethylorthosilicate  
5 h) OCTEO-S [n-octyltriethoxysilane, TECH];  
6 i) Octyltriethoxysilane;  
7 j) Methyltrichlorosilane [MTS]  
8 k) Chlorotrimethylsilane  
9 l) Chlorotriphenylsilane.  
10 m) Hexamethydisilazane;  
11 n) Octyltriethoxysilane [OTS];  
12 o) Propyltriethoxysilane;  
13 p) Dichlorodimethylsilane or  
14 q) dichlorodiphenylsilane),

15 Claim 12) The method of Claim 1 wherein the step of polymerizing comprises the steps  
16 of:

17 i) exposing the surface of the wood to a solution comprised of an organic solvent and at  
18 least one metal compound from the group consisting of:

- 19 a) Titanium tetrabutoxide [TBT],  
20 b) trimethylborate [TMB],  
21 c) Triethylborate,  
22 d) Boron halides,

- 1 e) borontrichloride,  
2 f) borontribromide,  
3 g) borontrifluoride,  
4 h) Triethylphosphate:  
5 i) Trimethylphosphate.  
6 j) Triethylphosphite:  
7 k) trimethylborate [TMB] ;  
8 l). Triethylphosphite  
9 m) triethylphosphite;  
10 n) Trimethylphosphite or  
11 o) Triphenylphosphite

12 Claim 13) The method of Claim 1 wherein the step of polymerizing comprises the steps  
13 of exposing the surface of the wood to reactive silicate containing carbon-silicon-halogen bonds  
14 in an organic solvent.

15 Claim 14) The method of Claim 1 wherein the step of polymerizing comprises steps of  
16 exposing the wood to a solution comprised of trimethylborate (TMB) and Methyltrichlorosilane  
17 (MTS).

18 Claim 15) The method of Claim 1 wherein the step of polymerizing comprises a the steps  
19 of exposing the interior layers of wood to at least one borax, sodium silicate, metal carrier or  
20 metalloid carrier to render the wood hydrophobic, bug , rot or fire resistant.

21 Claim 16) The method of Claim 1 wherein the step of polymerizing comprises the steps  
22 of exposing the surface of the wood to at least one reactive silicate having carbon-silicon-halogen

1 bonds to render the wood hydrophobic, bug , rot and fire resistant.

2 Claim 17) The method of Claim 1 wherein the step of polymerizing comprises the steps  
3 of:

4 A) Selecting at least one additive which may enhance at least one desired property  
5 from the group of properties comprising:

6 (a) Fire resistance,

7 (b) Insect resistance,

8 (c) Moisture resistance,

9 (d) Color;

10 (e) Adhesion,

11 (f) Insulation, and

12 (B) Changing the chemical structure of cellulose within the wood to change specific  
13 characteristics to the wood.

14 C) Adding the additive to the wood by at least one of the following methods;

15 (a) mixing particles of wood with the at least one additive and forming a wood  
16 composite;

17 (b) dissolving the at least one additive and flowing the additive into the wood or;

18 (c) pressing the at least one additive with the wood in a gas or solid phase.

19 Claim 18) The claim of Claim 17 further comprising the step of reforming the wood  
20 cellulose polymer to create a barrier to leaching of the additive from the wood.

21 Claim 19) The process of Claim 1 wherein the step of polymerization further comprising  
22 the step of exposing the wood to a solvent containing trivalent, tetravalent or penta valent atoms

1 and exposing the wood to ultra-sound sonification to facilitate penetration.

2 Claim 20) The method of Claim 1 wherein the step of polymerization further comprises  
3 exposing the wood surface to a aqueous solvent containing trivalent, tetravalent or penta valent  
4 atoms in an appropriate concentration and exposure time sufficient to attain a treatment content  
5 of wood in the range of 0.1 to 10% based on the original weight of wood.

6 Claim 21) The method of Claim 1 wherein the step of polymerization further comprises  
7 exposing the wood with at least one reactive silicate which replaces some of the molecules or  
8 atoms within the cellulose structure with silicon.

9 Claim 22) The method of Claim 19 wherein polymerization further comprises exposing  
10 the wood surface to a solvent under sonification in the ultra sound frequency range to attain a  
11 treatment content of wood in the range of 0.1 to 10% based on the weight of untreated wood  
12 samples.

13 Claim 23) The method of Claim 1 wherein the step of polymerization further comprises  
14 replacing hydroxyl groups within the wood cellulose with boron and silicon in the range of 0.1-  
15 10% by weight.

16 Claim 24) The method of Claim 1 wherein polymerization further comprises exposing the  
17 wood surface to which is preferably a carbon silicon halogen combination reactive borate having  
18 the general formula  $B(X)_3$  [boron reagent], where X is selected from a group consisting of a  
19 hydroxy group, methoxy, ethoxy, propoxy, butoxy or a higher alkoxy group with a straight or  
20 branched carbon chain consisting of 3-20 carbon atoms; a halogen, a phenoxy or benzyloxy.

21 Claim 25) The method of Claim 1 wherein the step of polymerization further comprises  
22 exposing the wood interior, before completing the step of polymerizing, to appropriate amounts

1 of treatments from the group comprised of metal or metalloid catalysts, chemical enhancers, borax,  
2 boron donors and sodium silicate to render wood hydrophobic, bug, rot and fire resistant.

3 Claim 26) The method of Claim 1 wherein the step of polymerizing comprises steps of  
4 placing the wood to be treated and chemicals in an enclosure under pressure.

5 Claim 27) The method of Claim 1 wherein the step of polymerizing further comprises the  
6 step of infusing moisture into the wood before polymerizing.

7 Claim 28) The method of Claim 1 wherein the step of polymerizing comprises the step of  
8 infusing molecular donors with trivalent, tetravalent or penta valent atoms within the wood prior  
9 to the addition of the solvent.

10 Claim 29) The method of Claim 1 wherein the step of polymerizing comprises mixing  
11 which is preferably a carbon silicon halogen combination chemical with trivalent, tetravalent or  
12 penta valent atoms in an organic solvent from the group consisting of alcohols, acetone, THF  
13 (Tetrahydrofuran), Poly dimethylsiloxane, acetonitrile, dioxain, methyltrichlorosilane or another  
14 organic solvent with a boiling point under a 100 degrees Centigrade.

15 Claim 30) The method of Claim 1 wherein the step of polymerizing further comprises the  
16 steps of:

17 a) adding to the interior layer at least one reagent to enhance wood properties from the  
18 group of properties consisting of:

- 19 a) diatomaceous earth,  
20 b) sodium silicates,  
21 c) boron or silicon salts,  
22 e) boric acid,



- 1 f) trimethy (trialkyl) borate,  
2 g) Boron Halides (BF<sub>3</sub>, BCl<sub>3</sub>, etc.),  
3 h) Boric Anhydride (boron oxide),  
4 i) phosphorous compounds,  
5 j) copper compounds,  
6 k) metal alkoxide,  
7 l) meta-phosphoric acid;  
8 m) a hydrophobic reagents,  
9 n) phosphoric acid,  
10 o) metaphosphoric acid

11 b) polymerizing the exterior layer to trap reagent with the wood.

12 Claim 31) A method for treating wood products having an interior layer and an exterior  
13 layer and a surface comprising the steps of:

14 a) adding to the interior layer at least one reagent to enhance wood properties from the  
15 group of properties consisting of:

- 16 a) diatomaceous earth,  
17 b) sodium silicates,  
18 c) boron or silicon salts,  
19 e) boric acid,  
20 f) trimethy (trialkyl) borate,  
21 g) Boron Halides (BF<sub>3</sub>, BCl<sub>3</sub>, etc.),  
22 h) Boric Anhydride (boron oxide),

1 i) phosphorous compounds,

2 j) copper compounds,

3 k) metal alkoxide,

4 l) meta-phosphoric acid;

5 m) a hydrophobic reagents,

6 n) phosphoric acid,

7 o) metaphosphoric acid

8 b) polymerizing the exterior layer to trap reagent with the wood.

9 Claim 32) The method of Claim 30 comprising the additional step of polymerization further  
10 comprises the step of exposing the surface of the wood to at least one reactive silicate having  
11 carbon-silicon-halogen bonds which have a carbon silicon-portion in a solvent to replace hydroxyl  
12 groups with the carbon silicon portion of the reactive silicon.

13 Claim 33) A cellulose molecule in a wooden structure wherein at least one hydroxyl group  
14 in the cellulose polymer is replaced with an atom or molecule from the group consisting of:

15 a) R-Xa

16 or

17 b) R3-Xa

18 wherein R is a carbon compound, Xa is a trivalent, tetravalent or penta valent atom and Xb is a  
19 reactive seven valence halogen, a hydroxyl group, an alkoxy group, propoxy, butoxy or an alkoxy  
20 group with the number of carbons ranging from 3 to 20 in a straight chain or a branched chain  
21 configuration a phenoxy group, a benzyloxy group or an aryloxy group in which the aromatic ring  
22 is replaced with a polycyclic aromatic ring.

1 Claim 34) The method of claim 2 wherein the method further comprises:

2 1) adding to the solution at least one reactant which is an acid of sufficient strength to  
3 catalyze the reaction.

4 Claim 35) The method of claim 2 wherein the method further comprises:

5 1) adding to the solution at least one reactant which in situ produces an acid of sufficient  
6 strength to catalyze the reaction.

7 Claim 36) The method of claim 2 wherein the method further comprises:

8 1) adding to the solution at least one reactant which is an base of sufficient strength to  
9 catalyze the reaction.

10 Claim 37) The method of claim 2 wherein the method further comprises:

11 1) adding to the solution at least one reactant which produces a base in situ of sufficient  
12 strength to catalyze the reaction.

13 Claim 38) The method of Claims 34 wherein the step of polymerizing comprises the step  
14 of infusing molecular donors with trivalent, tetravalent or penta valent atoms within the wood  
15 prior to the addition of the solvent.

16 Claim 39) The method of Claim 2 wherein the at least one compound is at least one  
17 carbon alkyloxy and wherein the step of polymerization further comprises the steps of:

18 1) Adding at least one acid to the solution to catalyze the polymerization.

19 Claim 40) The method of claim 38 wherein the acid is in solution from .1% to 10%.

20 Claim 41) The method of claim 39 wherein the acid is added indirectly by adding a  
21 substance which reacts with water in the wood to yield an acid.

22 Claim 42) The method of claim 39 wherein the acid comes from the group of compounds

1 of the formula  $R-Xa-Xb_3$  wherein R is a carbon compound;

2 Xa is a trivalent, tetravalent or pentavalent atom; and

3 Xb is a reactive seven valence halogen.

4 Claim 43) The method of claim 38 where the at least one carbon alkyloxy has the  
5 formula  $R-Si(OR')_3$  wherein R and R' are alkyl groups. *d*

6 Claim 44) The method of claim 38 further comprising the step of adding free boron  
7 compounds in concentration under .1% to 5% prior to the step of polymerization.

8 Claim 45) The method of claim 38 further comprising the step of adding a reactive boron  
9 reagent of the type discussed above may be used to form a boron matrix such as that disclosed in

10 Figure 10 when used in conjunction with a reactive silicate.

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